TABLE II.—*Supplementary List of peculiar Arenaceous Forms.*

See figs. 1–4 and 7.

FORAMINIFERA.	Labrador.	Gaspé Bay, 10 fathoms (sand).	Gaspé Bay, 10 to 15 fathoms.	Gaspé Bay, 16 fathoms.	Gaspé Bay, 18 to 20 fathoms.	Gaspé Bay, 16 to 17 fathoms.	Gaspé Bay, off Grande Grève, 35 fathoms.	Gaspé Bay, off Grande Grève, 10 to 50 fathoms.	Gaspé Bay, St. George's Cove.	River St. Lawrence, off Cape Rosier (Whiteaves).
Lituola findens, *D. & P.* (fig. 1).	.....	.....	.....	*C L	*	*	.....	.....	*R	
Hippocrepina indivisa, *D. & P.* (fig. 2).	.....	.....	.....	*C L	*C	.....	.....	.....	.....	
Lituola cassis, *D. & P.* (fig. 3)	.....	*	*C	*C L	.....	*	.....	.....	.....	
—— scorpiuris (fig. 4).	*	.....	*C	*C L	*	*C	*C L	*C	*C	*C L
—— ——, var. (fig. 4).	.....	.....	.....	*C L	.....	.....	*C L	.....	.....	
Rhabdopleura ? (fig. 7)	.....	.....	.....	.....	.....	*	*C L	*	*C L	*C L

XI.—*Outline of some Observations on the Organization of Oligochætous Annelids.* By E. RAY LANKESTER, B.A. Oxon.

FOR some time past I have, as opportunity offered, examined the structure of the freshwater and terricolous Annelids. I have already published an account of the larval form of *Chætogaster* (Trans. Linn. Soc. 1868), and of its sexual form (Quart. Journ. Microscopical Science, 1869), to which I have now something to add; I have also briefly described the remarkable genital setæ which characterize *Nais* equally with *Chætogaster* (Ann. and Mag. Nat. Hist. 1869), and have shown that the Naididæ as a group present in their development two very distinct forms—the one larval, reproducing by fission, the other sexual, of a limited number of segments, provided with additional segments interposed between segments present in the larva, arising by new growth, bearing peculiar setæ and the generative organs—the setæ of the whole worm differing also to some extent in the adult and larval forms.

The mud-banks of the Thames about and below London swarm with countless masses of red worms belonging to the Sænuridæ; and these, besides others from ponds at Hampstead, have furnished me with abundant material. I propose to give a short statement of some new facts, which I hope to illustrate with detailed drawings hereafter. The immense profusion of the worms in the Thames mud, of which they are the almost solitary occupants of high organization, is surprising. They appear to exist under the most favourable conditions as re-

gards food, attaining sexual completeness in winter as well as in summer, unchecked by any competition or by assailants.

1. *Families of the* Oligochæta.—The Oligochæta are best primarily divided as proposed by M. Claparède, into the *Terricolæ* and the *Limicolæ*. The former group has been but little studied, with the exception of the typical genus *Lumbricus*, and is not as yet broken up into families; it includes the genera *Lumbricus*, *Perichæta*, *Phreoryctes* and others, characterized by much greater histological and organological differentiation than is met with in Limicolæ. The Limicolæ have been divided into three families, Sænuridæ, Enchytræidæ, and Naididæ; but I should be inclined to place the Enchytræidæ as a subgroup with Sænuridæ, since only in this way can full weight be given to the very distinctive characters of the Naididæ. We thus have Lumbricidæ = Terricolæ, whilst Sænuridæ and Naididæ = Limicolæ. The Naididæ are further divisible into Naidinæ and Chætogastrinæ.

2. *New Species of* Sænuridæ.—The determination of species amongst these worms is very difficult, for two reasons:—first, that authors are not agreed as to what characters are important, and give descriptions of varying incompleteness; and secondly, that it is not possible as yet to say what are the limits of variability and the phases of development in one and the same species.

The most abundant worm in the Thames mud is the *Tubifex rivulorum*, described some years since with much care by M. Jules d'Udekem. Two other worms, however, are very abundant, living inextricably mixed with it in masses: these are a species of *Limnodrilus* and another, very interesting *Tubifex*. No observer has recorded *Limnodrilus* (of Claparède) in England; but I have found it abundantly in many localities, represented by three species. That in the Thames appears to be the first of M. Claparède's species, *L. Udekemianus* (Recherches sur les *Oligochètes*), being characterized by brown patches in the posterior segments, caused by stellate pigment-cells forming the endothelium of the perivisceral cavity (figured by me in Quart. Journ. Microsc. Science, July 1870). Another *Limnodrilus*, which I have obtained from an old pond at Hampstead, differs from either of Claparède's species in its great size (4 inches in length), as well as in the number of the setæ. In another series of specimens, which I think will prove specifically distinct, the chitinous tube in the copulatory organ is of enormous length as compared with those figured by the Swiss Professor. I have found that specimens of these and other worms may be mounted with great facility, and kept for reference, by means of glycerine jelly.

The second species of *Tubifex* in the Thames I first obtained with Mr. Kent in the Victoria Docks. I have since had specimens in abundance from near Barking. In this form, which differs in no respect from *T. rivulorum* when closely examined by the naked eye or low powers, the setæ of the dorsal row of the first ten segments present, when highly magnified, a form seen in no other Oligochætous Annelid, recalling by its specialization the setæ of some Polychæta. The bifid apex has its prongs directed forwards, and widely divergent, the interval being occupied by a finely ribbed membrane, which is somewhat depressed between the two prongs (fig. 1 *b*). With these

Fig. 1.

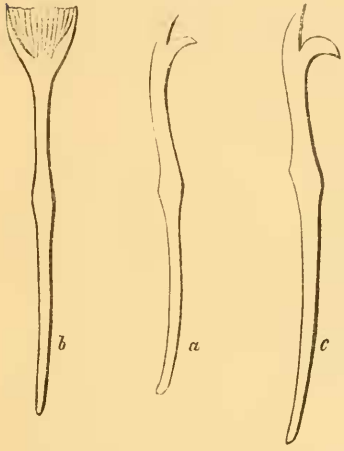

Fig. 2.

are associated from one to four capillary setæ in each bundle. The setæ of the first ten ventral (*i. e.* on the neural aspect) fascicles are small and of the usual crochet form (fig. 1 *a*); but after the tenth setigerous segment, the setæ, both in the dorsal and ventral fascicles, assume a very marked stout form (fig. 1 *c*), resembling those of *Lumbriculus*, and differing very clearly from those of *T. rivulorum*. The webbed or palmate dorsal setæ of the first ten segments appear to act in concert as so many oars, propelling the worm by the pressure of their flat surfaces on the water. This species of *Tubifex* differs further from *T. rivulorum* in the narrowness and elongation of that part of the male efferent duct which lies between the enlargement upon which the gland called "seminal vesicle" by Claparède is grafted and the proper penis. This portion, unlike what occurs in *T. rivulorum* or the two species figured by Claparède, is non-glandular, and resembles the corresponding

part in *Limnodrilus*. This is a very important distinction. A further character is found in the spermatophores (bodies occurring in the spermatic reservoirs, which I have shown to be agglutinated masses of spermatozoa, and on which Claparède founded his genus of parasitic Opalinoid parasites, *Pachydermon*). In the new form these are elegant and tapering at each end, whilst in *T. rivulorum* they have a curious conical extremity, due to moulding in the mouth of the reservoir. On describing the setæ of this new form to Prof. Leuckart, last April at Leipzig, he told me that he had just seen a description of such setæ, and handed me a Russian work, 'The Memoirs of the first Meeting of Russian Naturalists at St. Petersburg, 1868, Supplement,' in which is a paper entitled "Materials for the knowledge of Onega Lake and Territory in their Zoological Aspect," by Karl Kessler. By the kindness of Dr. Alexander Brandt, who was fortunately present, I was made acquainted with the contents of this paper. Several Oligochætous Annelids are imperfectly described, and among them *Sænuris* or *Nàidina umbellifera*, which is evidently the new Thames worm, though no anatomical details are given, except that the genital openings are in the ninth and tenth fasciculate segments. The palmate setæ are figured, but not well, and it is obvious the artist had not a very high-power microscope. Six specimens were obtained from mud by Lake Ladoga; and the specific name "*umbellifera*" is given, which I therefore accept for the Thames worm, which stands as *Tubifex umbellifer*. The genital openings in this species are placed as in the *T. rivulorum*, with which it is associated, viz. those of the spermatic reservoirs in the ninth fasciculate segment, those of the male ducts in the tenth fasciculate segment. The number of setæ and their form in a well-developed specimen were as follows:—(1) Ventral, 3 of *a* (fig. 1); Dorsal, 5 of *b* (fig. 1) and 2 capillary setæ. (2) V. 4 of *a*; D. 5 of *b*, 3 cap. (3) V. 4 of *a* (larger); D. 8 of *b* (larger), 3 cap. (4) V. 3 of *a*; D. 9 of *b*, 4 cap. (5) V. 3 of *a*; D. 8 of *b*, 3 cap. (6) V. 3 of *a*; D. 8 of *b*, 4 cap. (7) V. 2 of *a*; D. 5 of *b*, 3 cap. (8) V. 2 of *a*; D. 5 of *b*, 2 cap. (9) V. 3 of *a* (small); D. 4 of *b*, 1 cap. (10) V. 2 of *a* (small); D. 2 of *b*, 1 cap. (11) V. 2 of *c*; D. 3 of *c*, 1 cap. (12) V. 2 of *c*; D. 2 of *c*. (13–18) same as (12), then 2 of *c* in each ventral and 1 of *c* in each dorsal fascicle, with no capillary setæ for the rest of the worm. This specimen was not in a sexual state, though of large size ($1\frac{3}{4}$ inch).

It is a question whether *Tubifex umbellifer* has been introduced into the Thames by ships. It is very abundant in parts.

3. *Setæ of* Tubifex rivulorum.—A careful study of the setæ of

this species, consequent on the observation of the last species, has shown me that in *T. rivulorum* there is a rudimentary web to the dorsal setæ of the first ten fasciculate segments, and even traces of such a web as far as the fifteenth. This and the peculiar form of these setæ has not before been described. Though considerably smaller relatively, yet the setæ in this region approach those of *T. umbellifer* also in form, having the form seen in *b*, *b'*, fig. 2, with the prongs nearly straight, unlike those of the ventral region and of the other parts of the body (*a*, fig. 2). It requires a glass of very good power to see this web well—a $\frac{1}{16}$ or Hartnack's 10 *à immersion*. It is most developed in the setæ of the sixth and seventh fascicles, and is to be made out, though very slight, in the setæ of the fourteenth fascicle, where the prongs have assumed the uncinate form characteristic of most Oligochætous crochet-bristles. A remarkable fact is, that in young (*i. e.* small) specimens of *T. rivulorum* the webbing of the bifurcation of these bristles is more obvious than in the older and larger individuals. This suggests the supposition that *T. umbellifer* represents a more primitive form, and that the rudimentary webbing of the setæ of *T. rivulorum* is a case of retention, in a rudimentary state, of ancestral characters which were formerly highly developed. When it is remarked, further, that such a form of seta is unknown except in marine Annelids, and that, as far as it appears, *T. umbellifer* is a *brackish-water* form, the rudimentary webbing in *T. rivulorum* becomes more important.

I have seen no trace of such webbing in the setæ of *Limnodrilus* (which is consequently thus further separated from *Tubifex*), nor in any other Oligochætous Annelid examined with care for this purpose.

Four or five very fine hairs, of six times the length of the setæ, are often to be seen, in small specimens of *Tubifex*, surrounding each seta near its apex; they apparently result from the splitting-up of the horny substance of the seta; and they occur in *Nais* as well. Small dark particles are placed at intervals along these fine hairs. These appearances are probably pathological, but are so common as sometimes to lead one to suppose them characteristic and normal.

4. *Enchytræus* and *Pachydrilus*.—In a garden-heap I have obtained specimens of the typical *Enchytræus vermicularis*; whilst from a pond at Hampstead, from a running stream, and from the Victoria Docks I have obtained worms which should be referred to *Enchytræus*, but possess blood coloured red by hæmoglobin. That from the Hampstead pond is marked with light-yellow bands externally, and is otherwise colourless. There does not seem to be sufficient ground for

the genus *Pachydrilus*, to which these forms with red blood would be referable.

5. *Endothelium of the Perivisceral Cavity.*—The perivisceral cavity of the Oligochæta is lined with a more or less complete cellular membrane, which is *directly continuous* with the coarse-grained yellow cellular layer covering the large vessels and alimentary canal. The continuity of this layer has been hitherto overlooked. The whole endothelium, whether the visceral or the parietal portion, casts off its cells into the perivisceral liquid, where they float. The large bladder-like cells seen in *Limnodrilus* surrounding the coils of the segmental organ, and figured by Claparède, are simply continuations of the general endothelium, and are to be seen in *Tubifex* also. The parietal endothelium is more complete in *Limnodrilus* than in *Tubifex*, and the cells are large and clear, branching and anastomosing with one another on the surface of the internal muscular layer of the body-wall. In one species, as before mentioned, they are pigmented. In *Tubifex* there are very few cells indeed of the parietal endothelium on the muscular surface; but they are densely lodged in four grooves running longitudinally and placed between the longitudinal bands of muscular tissue. In *Tubifex* the cellular elements of the muscular tissue, as well as the cells of the parietal and visceral endothelium, are shed into the perivisceral liquid. This also takes place in other Sænuridæ. In *Chætogaster* there is no parietal endothelium, and the septal muscular fibres are branched cells with nuclei. In *Nais*, cells similar to those of the so-called hepatic tunic of the intestine are to be seen fixed to the body-wall, representing the parietal endothelium.

6. *Generative Organs of* Tubifex.—M. Claparède gave a very fair account of the genitalia of several Oligochæta in his 'Recherches,' adding much to what M. d'Udekem had done. At the same time I have been led to differ very much from Claparède on some important points.

It is not correct to say that *Tubifex* is simply hermaphrodite. What occurs here appears to occur also in other Limicolæ, viz. that though both sets of organs are present, one sex or the other predominates: thus it is usual to find an excess of spermatozoa or an excess of ova. Some very instructive specimens have come under my observation, in which the organs in the ninth fasciculate segment, viz. the testes and receptaculum seminis, were entirely undeveloped and not even represented, whilst those in the tenth (viz. the ovary and male efferent apparatus) were of full adult size; many large ova, ripe for deposition, were present, and the male efferent canal,

penis, &c., with its expanded trumpet-like orifice opening in the ninth segment, totally devoid of spermatozoa, though working its cilia actively. The fact that a male and a female organ in the ninth segment were aborted, and a male and a female organ normally developed in the tenth, shows that there is no "solidarity" between the female organs as such, but that their development or abortion is due simply to the greater or less nutrition of their particular segment. These specimens were females in the essential, male in the accessory organs of generation.

Dr. Fritz Ratzel has recently given reasons for regarding *Tubifex* as exhibiting a dimorphism of the ovaries, the ova being usually detached as they develope from the terminal portion of the ovary which hangs in the tenth fasciculate segment in close contact with the glandular dilatation of the male efferent duct, whilst in other specimens floating masses of large ova are found freely in the body-cavity. I have observed the fact seen by Ratzel, but do not think it requires his interpretation. *Tubifex* occurs in the Thames in the sexual condition in winter and summer. In the autumn large specimens devoid of genital organs are to be found. In specimens taken in the summer I have sometimes seen a very curious condition of the ovary, masses of large ova being detached instead of one much larger ovum alone. I think, from the appearance of the substance of the ova and the condition of the copulatory organs, that this is an abortive development, ending in the degeneration of the ovaries, both they and the testicular elements becoming, after a certain season of activity, absorbed in the perivisceral fluid. I have also found curious corpuscles, evidently aborted sperm-cells, in the perivisceral cavity of *Tubifex* in the autumn.

The structure and position of the testis appear not to have been fully made out by M. Claparède or by other writers; and this is true not only of *Tubifex*, but of the other Oligochæta. Leydig's figure of the young testis in *Phreoryctes Menckianus* (Max Schultze's Archiv, vol. i.) is the only one which agrees with what I have seen. I have already figured the developing testis in *Chætogaster* (Quart. Journ. of Micr. Science, 1869); those of the other Oligochæta do not much differ from it. By examining very young specimens of *Tubifex* or *Limnodrilus*, the real nature and origin of the sacculate masses of zoosperms seen in adults may be ascertained. The young *Tubifex* of a quarter of an inch in length presents in the ninth fasciculate segment a pair of pyriform protoplasmic masses, very small, hanging one on either side of the nerve-cord; an exactly similar pair is seen in the

tenth segment: the former are the testes, the latter the ovaries. There is only one pair of testes, not two or three as supposed by Claparède, who, I imagine, did not examine the youngest specimens. In the minutest details of structure the ovary and testis are at this period identical, consisting of nuclei scattered in a common protoplasm. The testicular masses segment, forming groups of nucleated protoplasm, each nucleus of which gradually developes around it a demarcated area. The cells thus formed have the exact structure of the young ova. At this point their development diverges; for whilst the ova increase in size individually without proliferation, the young sperm-cells exhibit most active multiplication by division of their nuclei into two, three, and four, thus forming floating spherical or compressed aggregates of young sperm-cells. The further development of these I have carefully traced in several genera of Oligochæta. Several phases appear subsequently in the development of each mass of sperm-cells, which have not hitherto been described, and require illustration. At one period in the development of the sperm-masses (the protoplasmic masses which give rise at their periphery to sperm-cells) of *Limnodrilus* the whole mass has a tendency to fibrillate into zoosperms; and some of these masses assume elongated forms far thicker than normal zoosperms, and exhibit both protoplasmic contractile movements and the flickering motion of a cilium. This fact has a special interest in demonstrating the identity of ciliary and amœboid movement, of which Häckel has lately written (Biologische Studien, 1870). The innumerable spermatospheres which are thus developed from the original pair of testes fill the segment in which they are formed, and also dilate certain folds of the peritoneal membrane in connexion with the septa which separate the ninth from the adjacent segments; and thus a sheath is formed for these rapidly multiplying floating corpuscles. One thing is quite certain, that this sheath is not part of the original testis, and that at first the spermatospheres float freely in the perivisceral cavity, as I have figured them in *Chætogaster limnæi*. The sheath is in all probability only a part of the dissepiment between the ninth and tenth fasciculate segments; and it is pushed down, as described by Claparède, through several succeeding segments as the spermatic elements increase in number. This occurs equally in *Nais*. It also frequently happens that a similar sheath extends forwards, distended with spermatospheres detached from the pair of testes. It will be observed that this description differs from that of Claparède chiefly as to the position and character of the original testes. The large

sacculate bodies in the earthworm have the same origin as the sheaths containing spermatospheres in the Sænuridæ and Naididæ. Hering pointed out that these sacculi were not true testes, in opposition to D'Udekem, whose view I supported in a paper on the earthworm because I did not find the bodies described as testes by Hering. I do not now feel sure what the bodies called testes by him may be; but I have found the true testes in *Lumbricus* placed as in *Tubifex*. In *Lumbricus* there are at least two pairs. The true testes are clearly figured in an immature *Phreoryctes* (a Lumbricoid) by Leydig.

The view advanced by D'Udekem, that the penis in *Tubifex* is invaginated in the oviduct, is supported by Claparède. There is really no evidence to support this view; and, as stated by both these authors, it is purely hypothetical, favoured chiefly by the fact that no true oviduct has been found. The ripe ova descend through the septa of several segments in a *Tubifex* rich in ova, and they thus recede to a very considerable distance from the male genital opening. Hence it is difficult to comprehend how this can act as the orifice for the escape of the ova. The manner of the deposition of the ova can only be decided by observation, which is very difficult in this matter.

The glandular organ attached to the pyriform part of the male efferent duct has been called a seminal vesicle by Claparède, though he admits that he has never seen zoosperms in it. It is really, in all probability, a gland destined to secrete a cement to aid in forming the spermatophores, which very remarkable bodies occur in all the Limicolæ apparently, but were unknown to Claparède, since he mistook them, where he did find them, for parasitic Opalinoid Infusoria, giving to them the name *Pachydermon*. I have previously given reasons for regarding Claparède's various species of *Pachydermon* as spermatophores (Quarterly Journal of Microscopical Science, 1870); but I have now watched their formation, and more carefully ascertained their structure, so that the matter is beyond doubt. Claparède found species of *Pachydermon* in two species of *Clitellio* and in *Limnodrilus*, and mentions one seen by D'Udekem in *Tubifex*. I have obtained these bodies in great abundance in *Tubifex* and in *Limnodrilus*, and also in *Nais*. They occur in the spermatic receptacles, and are eminently characteristic of the different genera and species. They are formed by the moulding of the spermatozoa with a cementing substance in the long necks of the spermatic reservoirs. A curious conical head is thus given to the spermatophore of *Tubifex rivulorum*, corresponding to the shape of the orifice of the reservoir. The spermatophore of *T. umbellifer* has not this head, but is pointed, tapering at either end.

The spermatophore of *Limnodrilus*, again, is of a different shape, broad and rounded at one extremity, tapering at the other; that of *Nais* is very long and thin, the spermatozoa being simply twisted into a rope. In those of the Sænuridæ there is an axial canal filled with granular matter, or sometimes with shrivelled epithelial cells; the spermatozoa are set spirally round this canal, imbedded in the firm and tough cement so that only their extremities project. These extremities in *Tubifex* I generally saw in active movement whilst still contained in the seminal pouch, so that they propelled the spermatophore in most elegant curves through the water when liberated into it when this contained two per cent. of sodium chloride. The spermatophores of *Tubifex rivulorum* were of all lengths; sometimes quite short, little longer than broad, at other times they appeared as long, snake-like bodies; sometimes they were incompletely cemented, and sometimes the cement alone appeared to have assumed the form without imbedding any spermatozoa. The spermatozoa themselves, when fully developed, are thread-like filaments, without any distinct head, or rather with an unusually long and thread-like head, distinguished from the much shorter and somewhat slenderer filament by no demarcation, but by its mobility: the short filament is continually moving, bending over on itself, so as to give the appearance of a knobbed extremity with any but the highest powers of the microscope, since it remains in this reflexed position when at rest. The cementing substance of the spermatophores is probably secreted, to a large extent, in both *Tubifex* and *Limnodrilus*, by the seminal vesicles of Claparède, and in *Clitellio*, where these are wanting, by the glandular portion of the vas deferens. But it is clear that the thick cellular wall of the spermatic reservoir itself also takes a part in forming the cement, from the manner in which ill-formed spermatophores are sometimes seen adhering to the sides of the sac. In *Nais*, moreover, the vas deferens is most minute, with no glandular appendage whatever; the simpler form of spermatophore found in this worm is cemented entirely by the secretion of the walls of the spermatic reservoir.

The great distention of the spermatic reservoirs when filled with these bodies has not been sufficiently dwelt on. Both in *Nais* and *Tubifex* they become greatly elongated, and extend through several segments of the worm; their development is greatest in *Nais*.

7. *Genital Organs of* Chætogaster *and* Nais.—I have had further opportunities of seeing the genitalia of *Chætogaster limnæi*. The consecutive manner in which the various organs of generation are developed in this worm is curious. Specimens

in which there are ova and spermatospheres exhibit no trace of the genital setæ; and, again, when these appear, no trace of spermatic reservoirs, which do appear later, is to be seen. I have to add to my former description, that the genital setæ are not "stumpy," as there stated, except when young; they ultimately assume the same proportions as those of *Nais* (Ann. & Mag. Nat. Hist. 1869, vol. iv.), but exhibit a very slight notching of the apex, a trace of bifurcation. The fascicles of common setæ near which they lie indicate a distinct segment, so that there are two superadded to the larval series between the cephalic and abdominal series. Some distance anteriorly to these setæ a pair of spermatic reservoirs or pouches are developed, which, as I surmised at the time of my description of the worm, had not had time to make their appearance in the specimens formerly examined. These spermatic pouches were *ciliated* internally. At the base of each fascicle of genital setæ a very delicate and short vas deferens opens, not longer than a seta itself, ciliated within, but without any expanded trumpet-like extremity. This I had not seen in specimens previously to this autumn, but, from analogy with *Nais*, supposed such a simple vas deferens to exist. The very gradual and bit-by-bit development of the genitalia in the Naididæ is remarkable, and likely to lead to misinterpretation; but when we find spermatic pouches containing spermatozoa, we may feel sure that copulation has taken place, and hence that development is complete. Consequently there is not the same doubt about *Nais* as about *Chætogaster*. In *Nais serpentina* a very large pair of spermatic pouches open at the fourth pair of fascicles; between these and the normal fifth pair are the genital setæ, with very short, simple ducts opening at their sides (the vasa deferentia). There is clearly no "entonnoir vibratile" to these ducts; they are not longer than one of the setæ, and are very finely ciliated; they are so delicate and transparent as to be imperceptible generally through the dense cellular layer of the clitellus. The ova in the Naididæ float freely in masses in the perivisceral cavity, with one ovum enormously larger than the rest. I have observed one ovum in *N. serpentina* occupying three whole segments of the perivisceral cavity.

The cuticle of the sexual *Chætogaster limnæi* is very finely striated vertically, as seen in optical section. It was not sufficiently figured in my paper on this form.

8. *Sources of discrepancy.*—It cannot be too strongly insisted on that observations made at different seasons on the same species of Oligochæta may lead to different results. The differences of some writers are thus explained. It is necessary to follow each of these worms *at all seasons of the year*, from its deposition as an ovum to its natural death after a full life-period.

9. *Homogeny of the Spermatic Pouches and Vasa Deferentia with Segmental Organs.*—In *Tubifex* I have observed that in the ninth segment no representative structure precedes the spermatic pouches. They commence as nearly spherical inversions of the integument after the testis has attained some size. The condition of the vasa deferentia in the Naididæ is important in connexion with relation to the segmental organ. Their extreme simplicity (in which they differ notably from the Sænuridæ) would never have suggested an homogeny with the segmental organ as it commonly occurs. The common form (in the ancestral unisegmental Chætopod) from which the excretory segmental organ, spermatic pouches, and vasa deferentia have equally been developed was probably very simple. This is indicated by the simple form of the segmental organs in Polychæta, and the simple form of the vasa deferentia in Naididæ, as also the simple form of the spermatic pouches in all. The excretory segmental organs and the vasa deferentia of Sænuridæ are more closely related; and probably the latter were differentiated from the former at a later period in the development of the group than that at which the spermatic pouches and the simple male ducts of *Nais* and *Chætogaster* were evolved. It is remarkable that, in the case where special genital segments are developed (the Naididæ), both the segmental organ and setæ of these segments are of a more primitive form than those of the common locomotive alimentary segments; whilst in Sænuridæ, where the genital segments are present from the earliest period, and perform the functions common to all the segments or somites, the setæ and the segmental organ of one of the genital segments have the usual character of locomotive and secretory organs.

XII.—*The Tertiary Shells of the Amazons Valley.* By Henry Woodward, F.G.S., F.Z.S., of the British Museum.

[Continued from p. 64.]

[Plate V.]

The following is a list of the specimens recorded by Mr. Conrad.

Gasteropoda.

1. *Isæa*, Conrad.
   I. Ortoni, Gabb, sp.
   I. lintea, Conrad.
2. *Liris*, Conrad.
   L. laqueata, Conrad.
3. *Ebora*, Conrad.
   E. crassilabra, Conrad.

3 *a*. (Subg.) *Nesis*, Conrad.
   N. bella, Conrad.

4. *Hemisinus*, Swainson.
   H. sulcatus, Conrad.
5. *Dyris*, Conrad.
   D. gracilis, Conrad.
6. *Neritina*, Lamarck.
   N. Ortoni, Conrad.
   N. pupa, Gabb.
7. *Bulimus*, Scopoli.
   B. linteus, Conrad.